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FOREST RESEARCH DIGEST



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LAKE STATES FOREST EXPERIMENT STATION*

Forest Service

U. S. Dept. Agr.

HOW MANY DUCKS?

The duck situation has been receiving a steadily increasing amount of attention during the last few years. The number of hunters has been increasing and the duck population has been diminishing, although not entirely due to hunting. The droughts of recent years and the encroachment of civilization over a longer period, have destroyed many of the usual nesting grounds.

Because of the greatly decreased number of ducks last fall many conservation-conscious hunters expressed themselves in favor of a closed season this year. However, the increase in rainfall this season has led others to believe that the major crisis is past and that ducks will again be relatively plentiful.

C. M. Aldous of the Biological Survey spent six weeks observing the nesting progress of the ducks in the Provinces of Manitoba and Saskatchewan this spring in order that an accurate picture of the situation might be obtained. The same observer had traveled over these areas the preceding year and therefore was in a position to compare the two seasons. Taken as a whole the breeding grounds in these two provinces, in Aldous' opinion, will produce as many ducks this season as last with the possibility of a very slight increase in the number of one or two species. But any such increase will be quite insignificant in making up the shortage.

* Maintained in cooperation with the University of Minnesota at University Farm, St. Paul, Minnesota.

A number of years will be required before the ducks can be restored to any semblance of their former numbers. During these years the ducks must be given every opportunity; this means restricted hunting privileges and more work in restoring breeding and nesting grounds.

SOIL EROSION STATION

The Upper Mississippi Valley Soil Erosion Experiment Station is maintained at La Crosse, Wisconsin, by three cooperating agencies, the Soil Conservation Service, the University of Wisconsin, and the U. S. Forest Service. The Soil Conservation Service studies soil erosion on cultivated land and the University of Wisconsin operates the experimental farm.

The Lake States Forest Experiment Station is chiefly interested in studies of the effect of forest cover on run-off and soil loss on steep slopes. Three small watersheds, varying in size from 2.7 to 11.5 acres, have been selected for observation of these two factors. One watershed is timbered and protected from grazing; the second is timbered and grazed; the third is cleared of timber and grazed. These watersheds are isolated from the surrounding area by diversion ditches which prevent the precipitation falling outside the watersheds from running into them. Automatic devices for recording run-off - that part of the precipitation lost by running off the surface - have been installed on the watersheds. The amount of soil eroded is also measured. These two factors are determined for every storm. In this portion of Wisconsin, torrential summer rains occur frequently. A precipitation intensity of around eight inches per hour for example, was recorded for a short period during one storm in 1934. Forest cover has had a marked effect on run-off and soil loss as brought out in the "Forest Research Digest" for September, 1935.

Another experiment is designed to study the entire water cycle, namely, percolation, run-off, and evaporation. This is done by means of lysimeters which are large tar-lined, concrete tanks, filled with soil. Various cover crops will be grown in these lysimeters and their effects on the water cycle will be determined.

FALL *vs.* SPRING PLANTING ON SUPERIOR FOREST

The fall season is generally regarded as the most opportune time for planting in the Lake States due particularly to the long period of favorable weather. On the Superior National Forest, however, plantations made in the spring seem to fare better than those made in the fall. This is due in part to heaving of fall-planted seedlings but there appear to be other causes such as winter killing.

This fall the Superior National Forest, under the direction of Ranger Gordon Fox, and Planting Assistant Alex Karkula, is initiating a test for the purpose of obtaining more reliable data on the advantages and disadvantages of spring and fall planting.

Approximately 40 tenth-acre experimental planting plots will be laid out under different conditions of soil and cover where fall planting is being carried on. Two-year-old seedlings of Norway pine will be planted in scalps spaced 4 by 4 feet. Alternate rows will be planted in the fall and spring. Every other tree planted in the fall will be mulched with duff, grass, leaves, or other convenient material in order to determine if this treatment will prevent losses due to frost heaving.

If carefully carried out, these tests should yield reliable data as to whether spring should be favored over fall for planting on the Superior National Forest.

ADMINISTRATIVE JACK PINE STUDY

An interesting series of jack pine cutting plots has been established by the Chippewa National Forest near Cass Lake, Minnesota. The work was done under the direction of Arthur L. Hawkinson. Several different degrees of cutting were used. Since it has been clearly demonstrated that satisfactory jack pine reproduction cannot be readily obtained simply by leaving seed trees, a number of methods of ground preparation and slash disposal were tried out. Estimates of the amount of seed produced per acre and its viability were also made.

This administrative experiment in conjunction with the studies of the Experiment Station should be of help in solving the perplexing problem of obtaining natural jack pine regeneration.

CREEPING JENNY A MENACE TO SEEDLINGS

Bindweed, derisively referred to by farmers as "Creeping Jenny", does not confine its depredations to farm crops, but it is also a menace to planted tree seedlings and reproduction. Of the obnoxious weeds which encroach on shelterbelt plantings, bindweed, according to State Shelterbelt Director A. L. Ford of South Dakota, is by all means the worst. With a root system as deep as those of trees, it is difficult to eradicate even by intensive cultivation.

Not only is this aggressive weed troublesome in the Shelterbelt Zone, but this year appeared on cut-over areas on the Kawishiwi Experimental Forest on the Superior National Forest, according to R. K. LeBarron. The seed, no doubt, was brought in with hay for feeding horses used in logging and has spread all over recently cut areas, threatening to choke out valuable reproduction of spruce and jack pine. Once a good overhead shade is developed, it is believed the weed will be killed out, but before the young trees get large enough to accomplish this, the weed may do a great deal of damage.

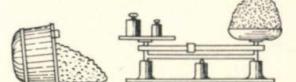
HOW MUCH JACK PINE SEED ON AN ACRE?

It is generally recognized that there is a great abundance of seed stored in the unopened cones in a jack pine stand. There is very little information, however, on the amount of seed per acre thus potentially available. The establishment of a jack pine cutting experiment on the Cutfoot Experimental Forest, Chippewa National Forest, afforded the opportunity to collect the cones from an entire acre of well-stocked jack pine 65 years old. At the time of collection the cones were sorted into four age classes, (1) 1935, (2) 1934, (3) 1932 and 1933, and (4) 1931 and older. The results are shown in the chart on the opposite page.

Of the 38.5 bushels of cones collected from the acre, the largest number belonged to the oldest of the four age classes. The yield of seed per bushel of cones varied considerably from one age group to another, but the highest was from the 1934 crop. The total quantity of seed per acre was about 13 pounds or 1,640,000 per acre.

Germination tests are now being conducted on seed of each group. Later, samples of the seed will be sown in the nursery and the seedlings will be planted in the field and their growth and survival will be carefully followed.

JACK PINE CONE STUDIES

AGE OF CONES	BUSHELS OF CONES PER ACRE	NUMBER OF CONES PER ACRE	OUNCES OF SEED PER ACRE	OUNCES OF SEED PER BUSHEL OF CONES
1931 AND OLDER	 $26\frac{1}{3}$ BU.	 74,946	 117.00 OZ.	1 BU. = 444 OZ. 
1932 & 1933	 $4\frac{1}{6}$ BU.	 19,003	 25.00 OZ.	1 BU. = 6.00 OZ. 
1934	 $5\frac{1}{9}$ BU.	 15,859	 47.80 OZ.	1 BU. = 9.35 OZ. 
1935	 $2\frac{11}{12}$ BU.	 7,461	 16.66 OZ.	1 BU. = 5.71 OZ. 

ARTIFICIAL PRUNING

An excellent bulletin* on pruning in coniferous plantations, based largely on work carried out on the Eli Whitney Forest near New Haven, Connecticut, has been published by the Yale School of Forestry.

Plantation-grown trees do not prune themselves as well as those in natural stands, and such aids to pruning as increasing the stocking are more costly and far less effective than artificial pruning according to this bulletin. Artificial pruning is necessary if clear lumber is to be produced on a rotation of 60-80 years, a relatively short period for such species as white pine and Norway pine.

Pruning should be restricted to 150 to 200 trees per acre, carefully selected so as to maintain an even spacing. Crown class, freedom from injury, and bole form must also be taken into account in choosing the trees for the final crop. These will usually be in the dominant and co-dominant crown classes. White pines which have been badly weeviled with resultant crookedness of the bole should not be pruned.

Most of the volume of plantation conifers managed on a short rotation is contained in the butt log. Accordingly, pruning should ordinarily be done only to a height of about 17 feet. The trees should preferably be pruned in three operations separated by intervals of 3-5 years. The first pruning should remove all limbs to a height of 6 to 8 feet; the next should clear the bole to about 12 feet; and the final operation should go to 17 feet. If done in one operation, it is necessary to wait until the highest interlacing branches have reached a height of at least 17 feet.

Pruning of live limbs, it is stated, has no detrimental effect on growth provided the operation is restricted to those receiving no direct sunlight, or in other words, to the highest whorl of branches interlaced with those of other trees. Although no data are presented to prove this contention, this Station reported an experiment on the effect of pruning on growth in the "Forest Research Digest" for August, 1935, which supports this statement.

* "Artificial Pruning in Coniferous Plantations", by R. C. Hawley and R. T. Clapp. Bulletin No. 39, Yale University, School of Forestry.

A hand pruning saw is considered a better tool than a pole pruning saw even though the hand tool has to be used from a ladder to remove the higher limbs. In the actual pruning, the objective should be to cut the branches as close to the trunk as possible without injuring the bark since short stubs prolong the period before clear wood is produced.

Although it is difficult to predict costs and rate of work due to variations in different tracts, on the average 75.7 linear feet of trunk can be pruned per man hour when a hand saw and ladder are used and pruning is done to 17 feet in one operation. The cost per acre (150 trees pruned) of pruning white pine to a height of 17 feet in three operations was \$16.65 with a labor rate of \$.50 per hour. When 200 trees per acre were treated, the cost was \$22.20.

STUMPPAGE PRICES IN NORTHERN MINNESOTA

Economic depression and the slump in lumber and paper prices have been reflected in a sharp decline in stumpage values in northern Minnesota, according to figures obtained by the Forest Survey.

One owner of timber near Duluth reports that accessible pine stumpage brought \$12 to \$14 per thousand six years ago, and is now worth only \$8 and \$9. On a less accessible tract, pine worth \$6 and \$7 six years ago now brings only \$4. Other typical comparisons in tracts reasonably close to the mills are:

	<u>1929</u>	<u>1935</u>
Spruce pulpwood per cord	\$2 - \$3	\$1 - \$1.50
Balsam pulpwood "	\$1 - \$1.25	\$.50 - \$.90
Aspen pulpwood "		\$.40
Jack pine pulpwood "	\$1 - \$1.50	\$.75
Birch ties each	\$.15	\$.10
Tamarack and cedar ties "	\$.10	\$.05

With stumpage prices as low as these on fairly accessible areas it is obvious that on more remote areas where trucking will add \$1.00 or more to the cost, stumpage values for some species are negligible. As a matter of fact, during the past few years farmers and truckers have logged and delivered wood at such low prices that only by figuring a ridiculously low value on human labor and truck depreciation could there be any stumpage value at all.

SHELTERBELT INVESTIGATIVE MEETING

The first Shelterbelt Investigative Meeting was held at Lincoln, Nebraska, on September 16-17. It was attended by Mr. Clapp and Mr. Norcross of the Washington Office, members of the Lincoln Office and three State Directors. The Station was represented by Bates, Eyre, Stoeckeler, Barnes, Frederickson, and Hayes (Bureau of Soils). Members of the Biological Survey, the Soil Conservation Service, the Division of Forest Pathology of the Bureau of Plant Industry, and the Bureau of Entomology also attended the meeting. The first day was taken up with a discussion of the administrative set-up and the results achieved to date.

On the second day the Station's program was discussed. So far the soils work has been especially valuable. The soils have been classified and mapped in actual field studies and recommendations made as to suitability for planting. A study of the influences of shelterbelts has been begun. The effect of existing shelterbelts on crop yields is being emphasized this year. Artificial barriers are being erected to simulate tree wind-breaks to determine the effects these have on the atmospheric conditions which are being measured by instruments.

The meeting brought out the need for a comprehensive research program to include studies along the following lines: genetics, seed biology, nursery practice, selection of planting sites, tests of species, planting methods, and shelterbelt influences.

RELATIVE MERITS OF STRIPS AND PLOTS IN CRUISING

No all-satisfying answer is possible to the perennial question of which cruising method, the strip or the line plot system, gives the more accurate results. However, sufficient advantage has been found to lie with the plot method that it has been adopted as standard by the Forest Survey organization in the Experiment Stations and is at least optional in most of the National forest regions.

The principal advantages of the plot method are these:

It permits absolute checking. If plot centers are marked, the checker can be sure that he is covering the same ground that the cruiser did and any differences found are errors of measurement and not accidents of sampling.

Heights can be more accurately ~~be~~ judged by a man standing still on a plot than by one pacing along a strip.

The tally man, if he stands in the center of the plot, can check the estimator in calling heights, species and culls.

If necessary, an estimator can work alone on a plot survey. One man strip surveys are unsatisfactory.

If the estimate is made by types, the plot has the advantage of being a definite and uniform unit of area. The strip must be computed as various fractions of an acre.

A theoretical advantage usually conceded to the circular plot method is that there are fewer line trees in a circular plot due to a smaller perimeter in proportion to the area enclosed. However, in the actual use of circular plots in the field it will be found that the strip method really has less perimeter because the strip is continuous and therefore the ends of the strip do not add to the perimeter. The perimeter of a fifth acre circular plot, a very common size, is 5.01 chains, while the perimeter of a fifth acre strip of one chain width is only 4 chains exclusive of the ends, which since the strip is continuous, are not boundaries except at the extremes of the strip, or at changes of type. This relationship changes as the strip width changes, but the values used here are very commonly employed. Tests have shown, however, that even when conscientiously done, strip surveys usually miss a number of marginal trees. With green men and no facilities for checking, these errors are likely to be serious. On the plots, the estimator's judgement of plot radius can be checked by that of the tally man and by frequent use of the tape. If the estimators are checked at regular intervals by the chief of party, errors in number of trees can be reduced to less than 1 percent.

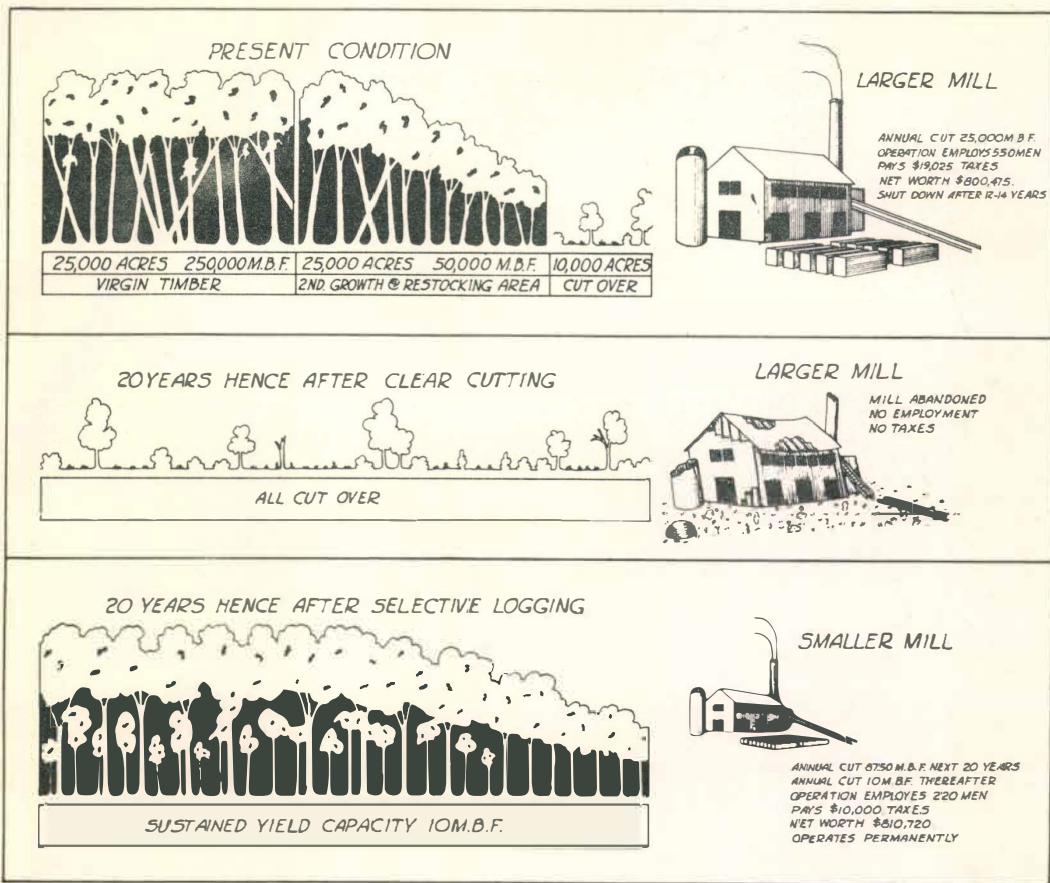
Data collected on plots may be subjected to statistical analysis for variability and accuracy more readily than data from strips of irregular length.

THE FINANCIAL PRACTICABILITY OF SUSTAINED YIELDS IN THE NORTHERN HEMLOCK-HARDWOOD FOREST

by C. H. Stoddard, Jr.

It has long been recognized that conservative lumbering is far more advantageous from the social standpoint than the cruder form of destructive liquidation. Only recently have foresters been able to show that sustained yield forestry is financially practical. Recent studies of logging costs show

RESULTS OF TWO METHODS OF CUTTING IN NORTHERN HARDWOODS



that selective logging can be practiced in many cases at less cost than clear cutting. The elimination of the depletion charge by growth, the longer period in which to write off permanent improvements, more reasonable forest land taxation and possible future lower interest rates through public forest credits, all play their part in improving the possibilities of permanent operations.

The best opportunities for improved forest management in the Lake States center in the remaining virgin hemlock-hardwood forests of Michigan and Wisconsin. It is estimated that of the fifty-odd larger companies owning standing timber at present, about half have an estimated life span from 10 to 20 years or more. The remainder are too nearly cut out to consider anything but government purchase of residual selectively-logged timber. In order to save a vestige of the Lake States lumber industry and the people dependent upon it for employment, it is imperative that the companies which are in a position to do so, adopt sustained yield practice before cutting has proceeded too far.

To illustrate the necessary adjustments, a specific case has been analyzed. The physical equipment as shown on the diagram is quite typical of operations of this class. The present sawmill production is too great for the available timber stands to support.

To change this company from a rapidly liquidating enterprise to one of continuous operation, certain definite management and financial changes must be adopted. By reducing the cut from 25,000 MBM annually to 8,750 MBM with careful selective logging, the volume removed will more nearly balance with volume growth. To offset the reduced income of this drastic action, definite savings will be made in lower taxation under the Forest Crop Law, cheaper logging and milling costs and higher lumber values from removal of only the larger diameter trees. Long-term forest credits through a public lending agency may soon be possible.

Capitalizing this smaller net income at 5% for a sustained operation shows a net worth of \$810,000 - or \$10,000 greater than under the shorter liquidation method with a higher annual income. Together with this financial advantage employment will be stable, the community permanent and the tax base sound. To bring about this desired condition it is absolutely necessary to have a recognition of social responsibility by the owning group.

CONVERSION TABLES AND CHARTS

A very useful bulletin entitled, "Converting Factors and Tables of Equivalents Used in Forestry", has been prepared by the Division of Silvical Research of the Forest Service. Its purpose is to facilitate the conversion of metric units into English equivalents. Certain simple conversions are easy to make and scarcely require tables, but when it is necessary to make the more difficult conversions such as cubic meters per hectare to board feet per acre, great care must be taken. The tables and alinement charts presented in this bulletin are easy to use and largely remove chances of error.

Other tables including conversion of Fahrenheit and Centigrade temperature scales, log rules, etc., are also presented. These are all selected because of their particular interest and usefulness to foresters.

The bulletin may be obtained from the Superintendent of Documents at a cost of fifteen cents. It is Miscellaneous Bulletin Number 225 of the Department of Agriculture.

SOIL PREPARATION AIDS ESTABLISHMENT OF SEEDLINGS

An experiment in broadcast sowing of jack pine seed carried out by Station personnel during the past spring at the Roscommon Forest Fire Experiment Station in Michigan demonstrates the benefits of soil preparation in obtaining a stocking of seedlings. Two open areas in the jack pine type were prepared for broadcast sowing. On one, slash was scattered and broadcast burned, and on the other, no slash was scattered or burned but the area was thoroughly disced. Seed was sown at the rate of 1.6 pounds per acre. The disced area was seeded April 25 and the burned area about three weeks later. The following table gives the results of the test:

Date of Examination	Number of Seedlings Per Acre		
	Broadcast	Burned	Disced
June 28	286		7,986
September 27		22	4,180

Most of the seedlings found at the time of the later examination were well established. Discing on the basis of this experiment, seems to have definite possibilities as a means of soil preparation to obtain regeneration.

CASH VALUE OF SHELTERBELTS IN CANADA

The value of shelterbelts may still be a cause for argument in this country but in a civil suit* a Canadian court has lent weight to the opinion that shelterbelts have a definite value. In this case, a landlord sued a tenant for damages to a windbreak of trees planted around farm buildings. The shelterbelt was damaged but not completely destroyed. The judge awarded the landlord \$1,000. While conceding that the damage could be repaired for quite a bit less, the judge held that the landlord was entitled to the amount awarded because the value of the shelterbelt would be lost during the few years needed for the damage to be repaired.

* "Success in Prairie Tree Planting", by Norman M. Ross. Forestry Branch Bulletin No. 72, Department of Interior of Canada.